

Title: ELECTRONIC VALVE READER

Inventors: Bertrand, Speckman, Golden, Sanders, Vincent and Morris

Docket No.: P-11490.00

CLAIMS:

1. An electronic magnetic-based indicator tool comprising:
a housing having an electronic display;
a plurality of magnetic field sensors, the plurality of magnetic field sensors grouped into sets of magnetic field sensors to determine spatial location and orientation of a magnetic device; and
a processing module for receiving magnetic data values from the plurality of magnetic field sensors and for determining a setting for a valve on an implantable flow control device using a determined orientation of a magnetic indicator device.
2. The electronic magnetic-based indicator tool according to claim 1, wherein the processing module further determines the setting of the valve on the implantable flow control device using a determined orientation of a reference magnet coupled to the implantable flow control device.
3. The electronic magnetic-based indicator tool according to claim 1, wherein the processing module generates a display image corresponding to the orientation of the implantable flow control device and outputs the display image on the electronic display.
4. The electronic magnetic-based indicator tool according to claim 1, wherein the processing module determines an estimate for ambient magnetic fields from a sequence of magnetic data values from the plurality of magnetic field sensors.
5. The electronic magnetic-based indicator tool according to claim 4, wherein the processing module further subtracts the estimate for ambient magnetic fields from received magnetic data values to determine the setting of the valve on the implantable flow control device.

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Docket No.: P-11490.00

6. The electronic magnetic-based indicator tool of claim 1, wherein the plurality of magnetic field sensors comprises four sets of three sensors for determining location and orientation of a magnetic device in five degrees of freedom.
7. The electronic magnetic-based indicator tool of claim 6, wherein each of the four sets of three sensors being located about a respective one of four corners of the indicator tool.
8. The electronic magnetic-based indicator tool according to claim 1, wherein the indicator tool further comprises an adjustment tool for modifying the orientation of the valve in the implantable flow control device.
9. The electronic magnetic-based indicator tool according to claim 8, wherein the adjustment tool comprises a magnetic adjustment component for magnetically coupling to the magnetic indicator device of the flow control device.
10. The electronic magnetic-based indicator tool according to claim 9, wherein rotating the adjustment tool while magnetic adjustment component is magnetically coupled to the magnetic indicator device of the flow control device causes the valve of the flow control device to rotate changing the setting of the valve.
11. The electronic magnetic-based indicator tool according to claim 1, wherein the tool further comprises:
 - a removable data storage device, the data storage device containing computer readable data for translating valve setting to pressure for the implantable flow control device.
12. The electronic magnetic-based indicator tool according to claim 11, wherein the removable storage device being from a group of removable data storage devices consisting of compact flash memory device, a secure digital memory device, a smart media storage device, and a memory stick memory device.

Title: ELECTRONIC VALVE READER

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Docket No.: P-11490.00

13. The electronic magnetic-based indicator tool according to claim 11, wherein computer readable data for translating valve setting to pressure for the implantable flow control device corresponds to a particular model corresponding to the implantable flow control device.

14. The electronic magnetic-based indicator tool according to claim 11, wherein the indicator tool further comprises user controls for activating the operation of the tool and a power supply.

15. The electronic magnetic-based indicator tool according to claim 14, wherein the power supply comprises a removable battery.

16. A system comprising:

an implantable medical device comprising a first magnet to indicate a current device setting;

an electronic magnetic-based indicator tool comprising:

a housing having an electronic display;

a plurality of magnetic field sensors, the plurality of magnetic field sensors grouped into sets of three magnetic field sensors; and

a processing module for receiving magnetic data values from the plurality of magnetic field sensors and for determining a setting for a valve on an implantable flow control device using a determined orientation of a magnetic indicator device coupled to the valve; and

an adjustment tool for modifying the orientation of the valve in the implantable flow control device, the adjustment tool comprises a magnetic adjustment component for magnetically coupling to the magnetic indicator device of the flow control device.

17. The system according to claim 16, wherein the processing module further determines the setting of the valve on the implantable flow control device using a determined orientation of a reference magnet coupled to the implantable flow control device.

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Docket No.: P-11490.00

18. The system according to claim 16, wherein the processing module generates a display image corresponding to the setting of the implantable flow control device and outputs the display image on the electronic display.

19. The system according to claim 16, wherein the processing module determines an estimate for ambient magnetic fields from a sequence of magnetic data values from the plurality of magnetic field sensors.

20. The system according to claim 19, wherein the processing module further subtracts the estimate for ambient magnetic fields from received magnetic data values to determine the setting of the valve on the implantable flow control device.

21. The system according to claim 1, wherein the tool further comprises:
a removable data storage device, the data storage device containing computer readable data for translating valve setting to pressure for the implantable flow control device.

22. The system according to claim 21, wherein the removable storage device being from a group of removable data storage devices consisting of compact flash memory device, a secure digital memory device, a smart media storage device, and a memory stick memory device.

23. The system according to claim 21, wherein computer readable data for translating valve setting to pressure for the implantable flow control device corresponds to a particular model corresponding to the implantable flow control device.

24. The system according to claim 21, wherein the indicator tool further comprises user controls for activating the operation of the tool and a power supply.

25. The system according to claim 14, wherein the power supply comprises a removable battery.

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Docket No.: P-11490.00

26. A method comprising:

placing an electronic magnetic-based indicator tool adjacent to an implantable medical device, the implantable medical device having a magnetic indicator device coupled to a valve used to control operation of the medical device;

measuring a magnetic field strength observed by the indicator tool;

estimating a portion of the observed magnetic fields caused by an environmental magnetic field;

determining an orientation of the magnetic indicator device relative to a known position of the implantable medical device using the observed magnetic field and the estimate for the environmental magnetic field; and

indicating a device setting of the implantable medical device.

27. The method according to claim 26, wherein the known position of the implantable medical device is determined from an expected orientation of the indicator tool relative to the implantable medical device.

28. The method according to claim 26, wherein the known position of the implantable medical device is determined from determining a location and orientation of a reference magnetic device coupled to the implantable medical device.

29. The method according to claim 26, wherein the measuring the magnetic field comprises:

receiving electronic signals from a plurality of magnetic field sensors, the magnetic field sensors grouped into a plurality of sets of three sensors located at separate locations within the indicator tool; and

processing the received electronic signals to determine an orientation and location of a magnetic device.

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Docket No.: P-11490.00

30. The method according to claim 29, wherein the plurality of sets of three sensors comprise four sets of sensor, each of the four sets of sensors being located about a respective one of four corners of the indicator tool.